Germany

Forges Ahead With Many Industrial Developments That Reflect Changing Economic Conditions in Which Chemical Engineering and Industry Will Play a More Important Rôle

WHY CHEMICAL INDUSTRY IS INTERNATIONAL

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WITHOUT EXAGGERATION, we may assert that no other industry essential to national life depends on international cooperation to such a high degree as the chemical industry. Every day new problems emerge — scientific as well as economic. These problems cannot be considered from a purely national point of view because they extend into the international sphere.

All countries with highly developed industries carry on chemical research on a large scale. We see, therefore, inventions originating not in one place only but in several. The history of science portrays numerous examples of important and entirely new ideas which have come to life almost simultaneously in two or more widely separated localities. Outstanding recent examples in this respect are the various processes for nitrogen fixation and synthetic rubber, the latter having been developed concurrently in Germany and the United States. Sometimes each inventor proceeds along entirely different lines from the other; then again, certain connections are apparent. In many cases, it would be of great interest to both inventors to be able to make comparative studies in order to improve each process.

Because science is interrelated to a very considerable extent, and because it is highly desirable to avoid costly and protracted patent litigation with its unpredictable results, mutual understanding on the part of all concerned is the obvious object to strive for. This condition almost compels the various interests to conclude international agreements.

On the other hand, a willingness for collaboration on scientific grounds is of special significance to chemical industry on account of the economic import that all inventions ultimately exercise. Usually, outstanding new developments in chemistry create products that are not confined within national boundaries. On the contrary, such new products find markets not only within neighboring countries but all over the world unless tariffs or other trade restrictions provide insurmountable obstacles.

In most cases it is necessary to negotiate trade agreements to assure normal development and outlets for new products and to avoid far-reaching disturbances in trade, for every new product bears a close relationship—at least economically—to other existing products and shows a tendency to upset trade.

Owing to these conditions, the large European producers of chemicals entered into agreements at an early stage. It was necessary to coordinate continued independence and to guarantee expansion, as far as home markets were concerned, and the legitimate export interests of all participants. The results were most encouraging, notably in the field of coal-tar dyes and nitrogen; the great majority of the principal European manufacturers have joined in these conventions. Connections have also been established with non-European producers with the exception of those in the United States, but no binding agreements have been concluded.

As for the United States, the anti-trust laws prohibit agreements such as those prevalent in Europe; but American producers have the advantage of still undeveloped markets and other favorable conditions. Therefore, cooperation with the principal American manufacturers is essentially limited to the scientific field.

As a sidelight on chemical engineering in Germany, it may interest American chemical engineers to learn that in this country we do not recognize the profession as do the United States and certain other countries. In general, we separate the functions into those of the chemists on the one hand, and of mechanical engineers on the other. But it is significant in the development of German chemical industries that both professions have collaborated intensively. Pure scientific chemical research, as practiced in the laboratories of our universities, is recognized by industry. In close collaboration with the chemist, engineers develop the technique for industrial applications of pure chemistry.

The claims on the inventive ability of chemist and engineer are constantly more exacting. The German chemical industry achieved its great success by continuous close cooperation between chemist and engineer, as is best illustrated by the development of the synthetic nitrogen and hydrogenation industries.

"RESEARCH IS POWER" In German Chemical Industry

Editorial staff summary of current developments based primarily on official reports of United States Consul Sydney B. Redecker, Frankfurt-on-Main, with certain supplementary data supplied by the Chemical Division, Bureau of Foreign and Domestic Commerce, Dept. of Commerce

GERMANY'S leading position in the chemical industry prior to the World War is a matter of common knowledge. In 1913 its share in the world production of chemicals amounted to almost 25 per cent, while of the total world exports of chemicals more than 28 per cent was of German origin. The corresponding figures for 1934 as published in *Die Chemische Industries*, January, 1936, are 16 per cent for production and 27 per cent for foreign trade of the world. When we consider the fact that in 1913 fully 32 per cent of the world's chemical production was involved in international trade, whereas by 1934 this proportion had dropped to only 12 per cent, it is evident that Germany has suffered a heavy loss through the building up of chemical industries in many countries. In spite of this, she is still maintaining her position in exports—with more than double those of any other nation.

During recent years the economic life of Germany has been deeply influenced by governmental regulations and the increasing shortage of foreign raw materials—both factors stimulating the development of substitutes and the utilization of waste materials. Chemical industry has benefited by these trends. In 1935 it had on its payrolls more than 400,000 employees of which at least 10,000 were qualified chemists. The volume of exports in 1935 increased by 13 per cent over those of 1934 and in addition there was a considerably higher domestic sale as indicated by an advance of 20 per cent in fuel consumption. Judged on the basis of man-hours of labor, production increased from 69.9 to 76.5 per cent of capacity. The best showing was made by the heavy chemical, explosives, paint materials and fertilizer industries while pharmaceutical and fine chemical industries increased their volume but decreased in value of output. Exports were stimulated by certain subsidies permitting lowered prices, but strict governmental control of the domestic market tended to depress profits and force the German chemical industry to absorb higher taxes and costs, such as increased freight rates.

Governmental regulation extends to prohibition of any increase in productive capacity in certain fields such as nitrogen, superphosphates, and lamp black. Trade practices have been standardized with the view to protecting the small and medium sized producer. On the other hand, industrial concentration is continuing both by vertical integration of subsidiaries and affiliates and by horizontal acquisition outside of the immediate field of the parent company. The Nobel group, for example, is consolidating its corporate structure; Kaliwerke-Salzdetfurt A.G. purchased a 30 per cent interest in Mansfield A.G. für Bergdau and Hüttenbetrieb, an important producer of copper, brass and light metals. Cartels and syndicates have made further progress, in some instances concluding international agreements such as the potash convention between producers in Germany, France, Spain and Palestine and the nitrogen pact extending over Europe, Chile and Japan.

Dependence on foreign raw materials for chemical industry is most pronounced in the case of vegetable oils, naval stores, crude botanical drugs, phosphates, borax, sulphur, pyrites, carbon black, petroleum and rubber. At least 25 trade control boards regulating raw material imports have been set up by the government, one of which specializes in chemicals and chemical raw materials.

With the slogan "Research is Power," the German chemical industry has intensified its activities in the development of new products, particularly synthetic materials produced from domestic sources. Special efforts have been made in the synthetic production of textile fibers, rubber, resins, motor fuels, technical oils and waxes. Synthetic rubber is now produced in a pilot plant from butadiene and is marketed under the trade name "Buna." It was introduced to the public at the recent International Automobile Show in Berlin and is said to be superior to the

Polymerization equipment used in the manufacture of the German synthetic rubber, "Buna."

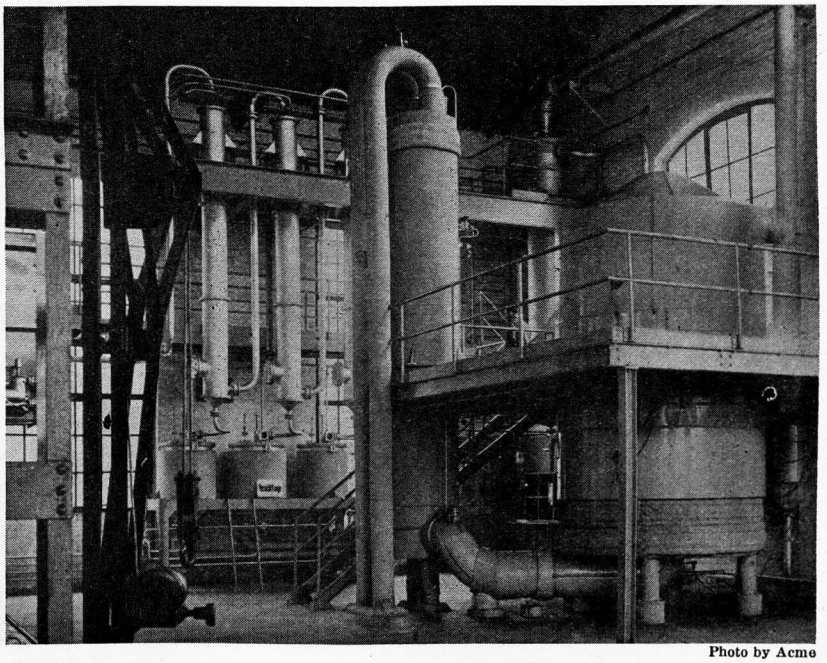


Photo by Acme

natural product in a number of respects. Tires are made from it by several German concerns and extended road tests have demonstrated their superiority. Buna is not affected by oils and acids, hence important industrial applications are indicated. A large-scale plant is already under construction.

Total consumption of motor fuel in Germany amounted to 2,000,000 metric tons in 1935. Of this quantity 1.22 million tons were imported, 350,000 tons were domestic benzol, 180,000 tons were alcohol used in admixture of 10 per cent, while the remainder was supplied by the hydrogenation of coal, lignite and tar and other sources. However, a number of important hydrogenation plants are under construction so that in the next few years there will be a considerable increase in the output of synthetic liquid fuel. A new process for liquefaction of coal has been developed by the Stinnes concern. The extraction takes place under pressure at gradually increasing temperatures from 300 to 450 deg. C. It is claimed that 85 per cent of the oil contained in the coal is extracted. This oil, poorer in hydrogen than ordinary diesel oil, is free from ash and may be used as motor fuel.

Coal-tar production increased about 12 per cent over 1934 to an estimated 1,350,000 tons. The demand was so great that stocks accumulated in former years were drawn upon and supplies of some products such as naphthalene, anthracene and carbasol were running short.

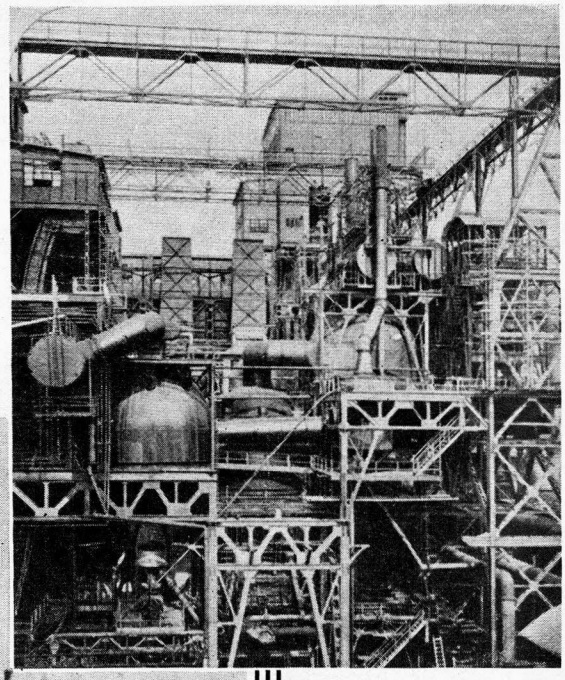
Production of dyes also showed a small increase over 1934 when the output was estimated at 76,000 tons, but values declined considerably. Fully 50 per cent of the production is exported. Pharmaceuticals extended their market as packaged proprietary preparations are being substituted increasingly for prescriptions. It is estimated that 80 per cent of the domestic market is accounted for by public-health insurance requirements.

The fertilizer industry showed considerable improvement of sales in all lines, both domestic and foreign. Increased efforts to stimulate domestic agricultural production in Germany resulted in fertilizer consumption in 1934-35 of 425,200 tons of nitrogen, 816,600 tons of K_2O and 542,000 tons of P_2O_5. Exports in 1935 rose to 684,000 tons of nitrogenous fertilizers, 390,720 tons of K_2O, and 36,400 tons of superphosphate. Potash exports increased especially to the United States and Japan. Production of superphosphates was over 720,000 tons and 1,400,000 tons of basic slag were produced in 1934. A new fertilizer, ammoniated peat, was put on the market in 1935 and was of interest because of its combined content of potash and phosphate.

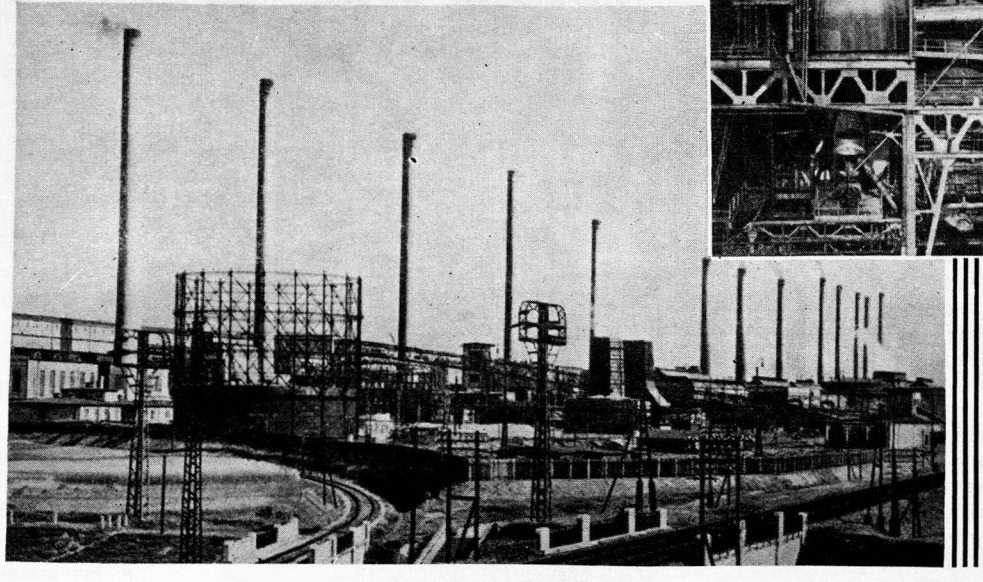
Production of alcohol from cellulose was placed on a commercial basis during the past year. A pilot plant using the Bergius process is in operation and there is a larger plant producing 26,000 gal. of alcohol through the saccharification process of Schoeller-Tornesch. Output of both plants was taken over by the alcohol monopoly, a governmental institution.

Undoubtedly the greatest progress has been achieved by synthetic resins. The production increased to about 25,000 tons or 50 per cent more than 1934. Exports amounted to over 5,000 tons. About 90 per cent of the output is of phenolic base, although carbamid resins are gaining in importance. Estimated production of synthetic resins in Germany as compared with the output in the United States in tons is shown in the following table:

Year	Germany	U.S.A.
1920	750	800
1925	3,000	6,000
1930	10,000	15,500
1933	19,200	22,500
Thereof: Phenol Resins	15,000	15,750
Urea-resins	1,000	1,600
Alkyd-Resins	3,000	5,000
Other art. resins	200	150



Winkler gas generators for producing hydrogen from brown coal for ammonia synthesis.



Leuna synthetic ammonia works of I. G. Farbenindustrie. Estimated maximum annual capacity (with Oppau) of more than one million metric tons of nitrogen.